SURFnet6 and NetherLight

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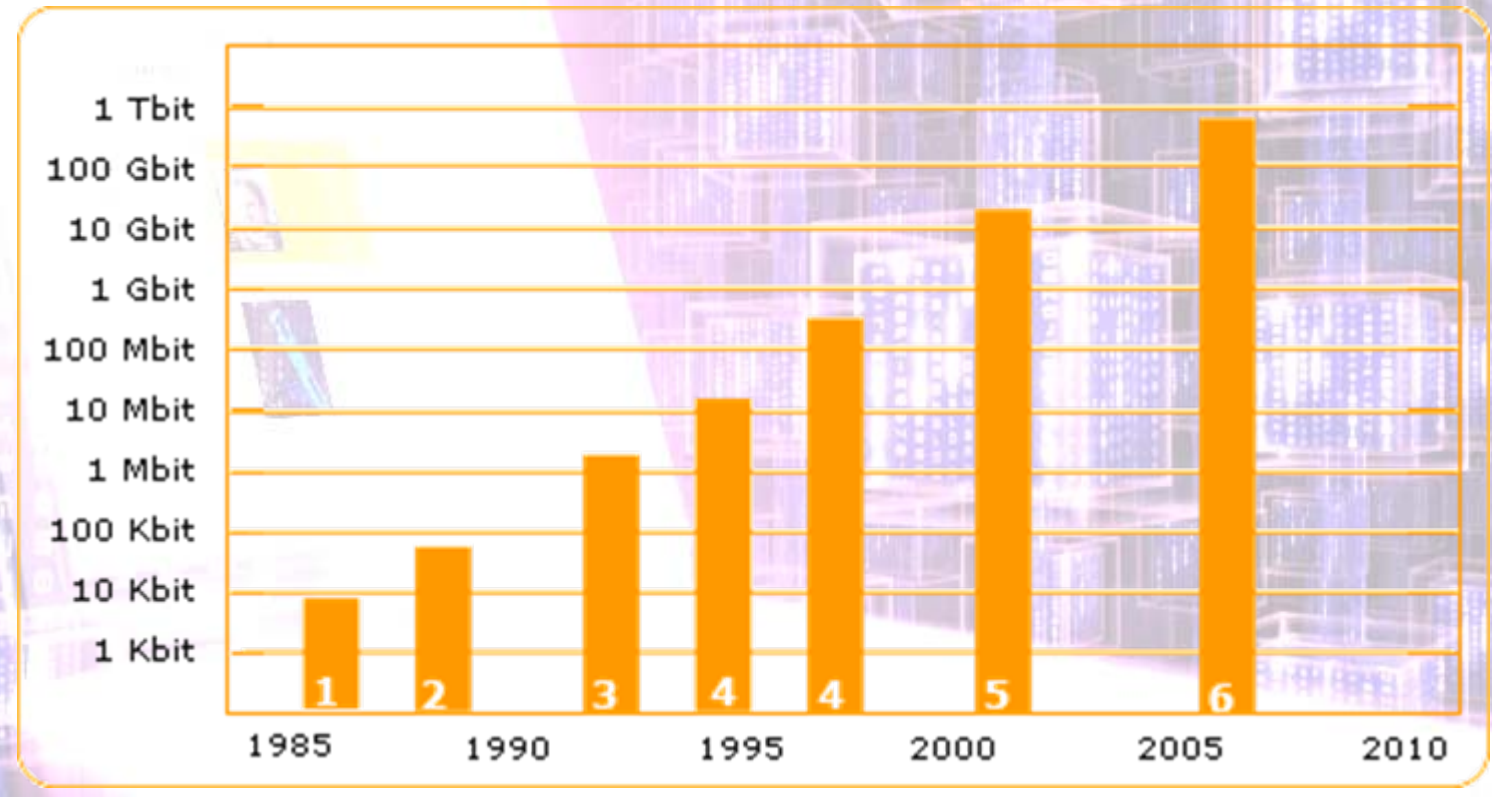
SURFnet network evolution



Astronomy

- eVLBI and JIVE
  - Lightpaths will replace tape and disk transport
  - Realtime correlation will become possible by making the network part of the instrument
- LOFAR
  - 25000 antenna's, Tera-bit/s data transport
  - Optical network is integral part of the instrument

Large Hadron Collidor (LHC)

CERN Atlas Pit construction

CERN: Large Hadron Collider

Demand for large data flows

"We need the network to

- distribute the data
- distribute the computing
- serve the distributed community
- operate the detectors
- communicate" *

Output: 16 Petabyte per year

(4 Gbit/s 24 x7)

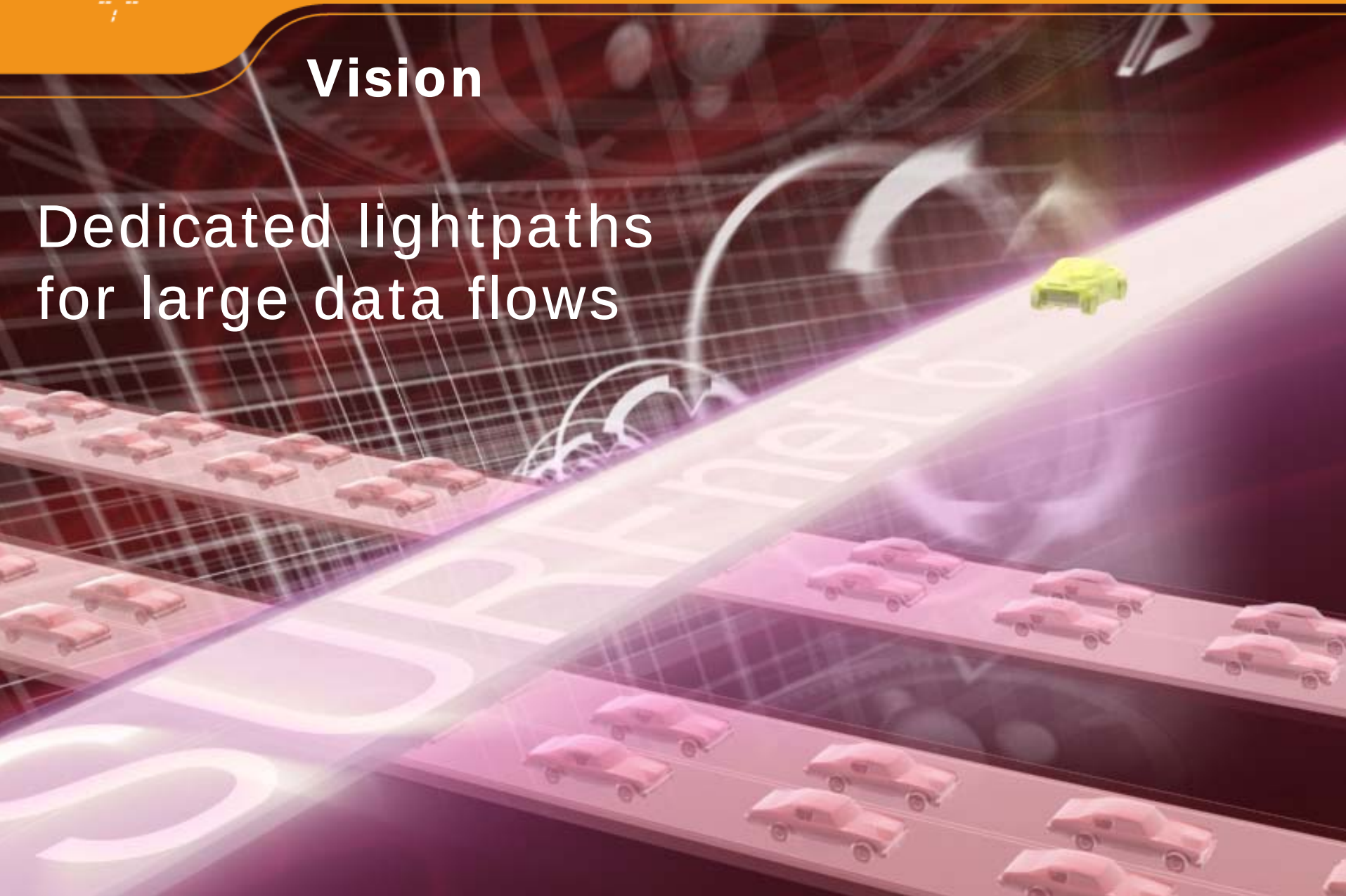
* Kors Bos, NIKHEF

SURFnet

GigaPort →

Vision

Dedicated lightpaths for large data flows



First steps into hybrid networking

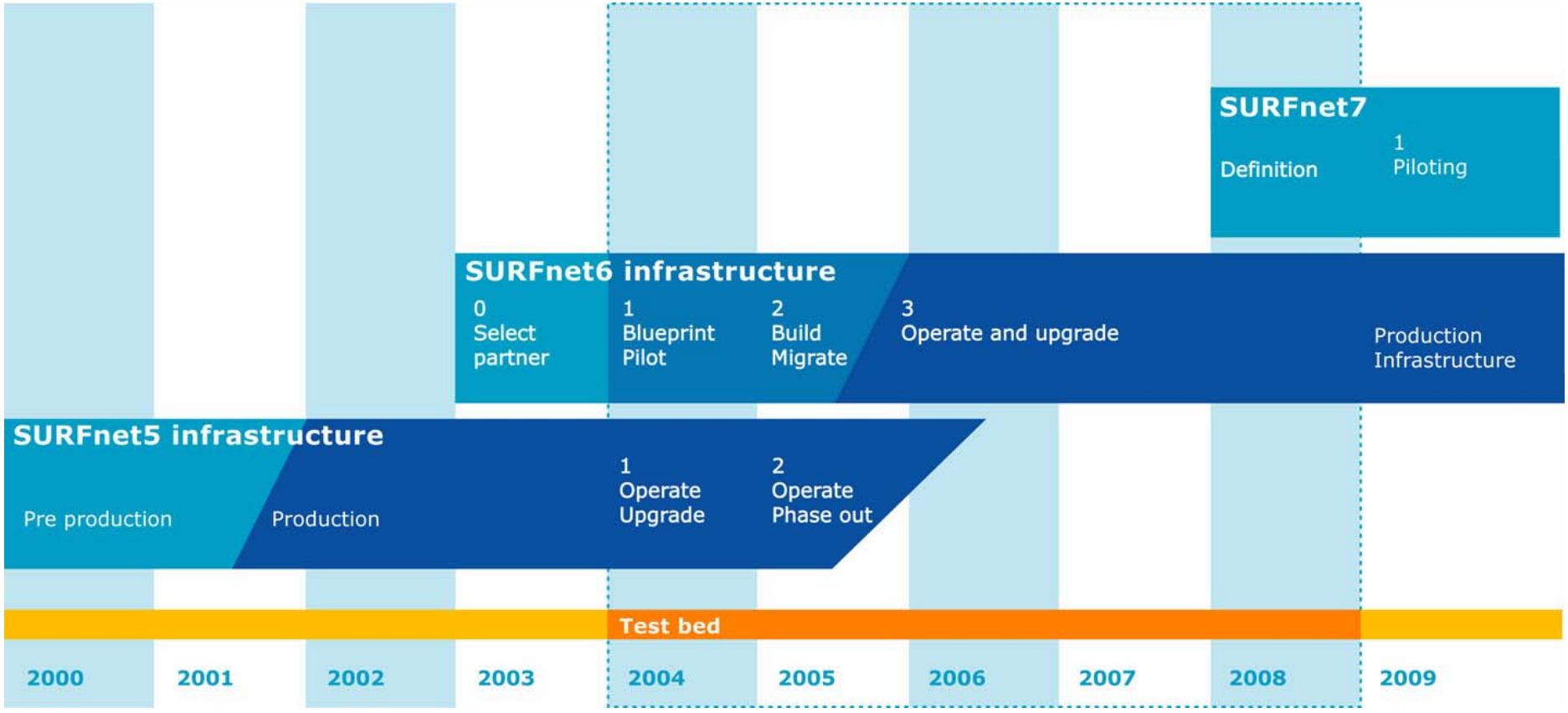
- **International co-operation**
  - Organisation of LambdaGrid workshop, 2001
  - Set up of GLIF, 2003
- **Proof of concept**
  - First transatlantic lambda Amsterdam - Chicago, 2002
  - Set up of NetherLight, 2002
- **Making it a reality**
  - Proposal for funding SURFnet6, first hybrid network
  - Participation in GLORIAD

SURFnet6 overview

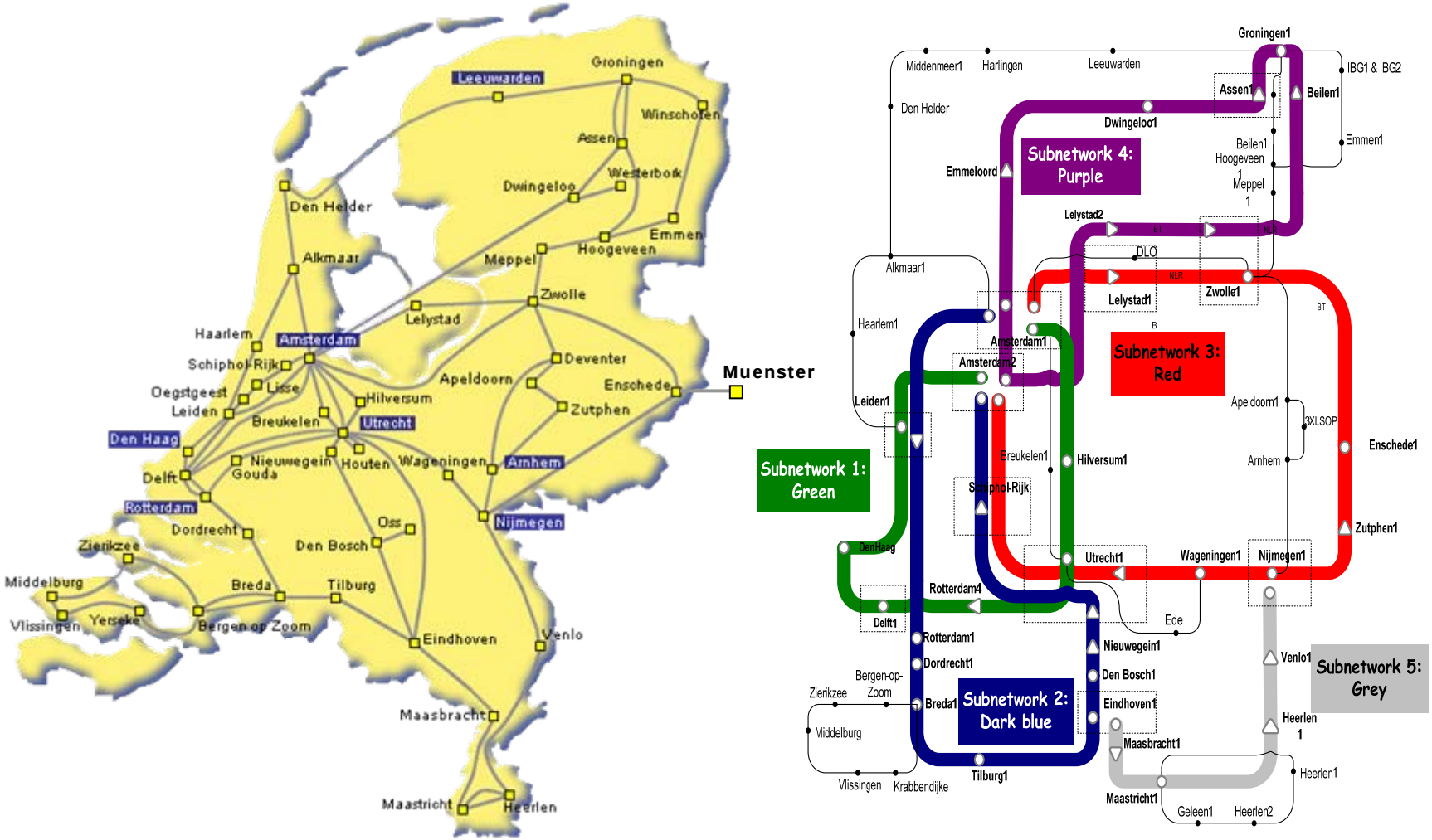
- The first nation-wide hybrid optical and packet switching infrastructure
- Based on 6000+ km of SURFnet-owned managed dark fiber, all the way to the customers premises
- SURFnet6 delivers all SURFnet5 services (native IPv4 and IPv6) plus Lightpath Provisioning:
  - Over a single transmission infrastructure
  - Managed via a single control plane

  Hence, in an economically sound way

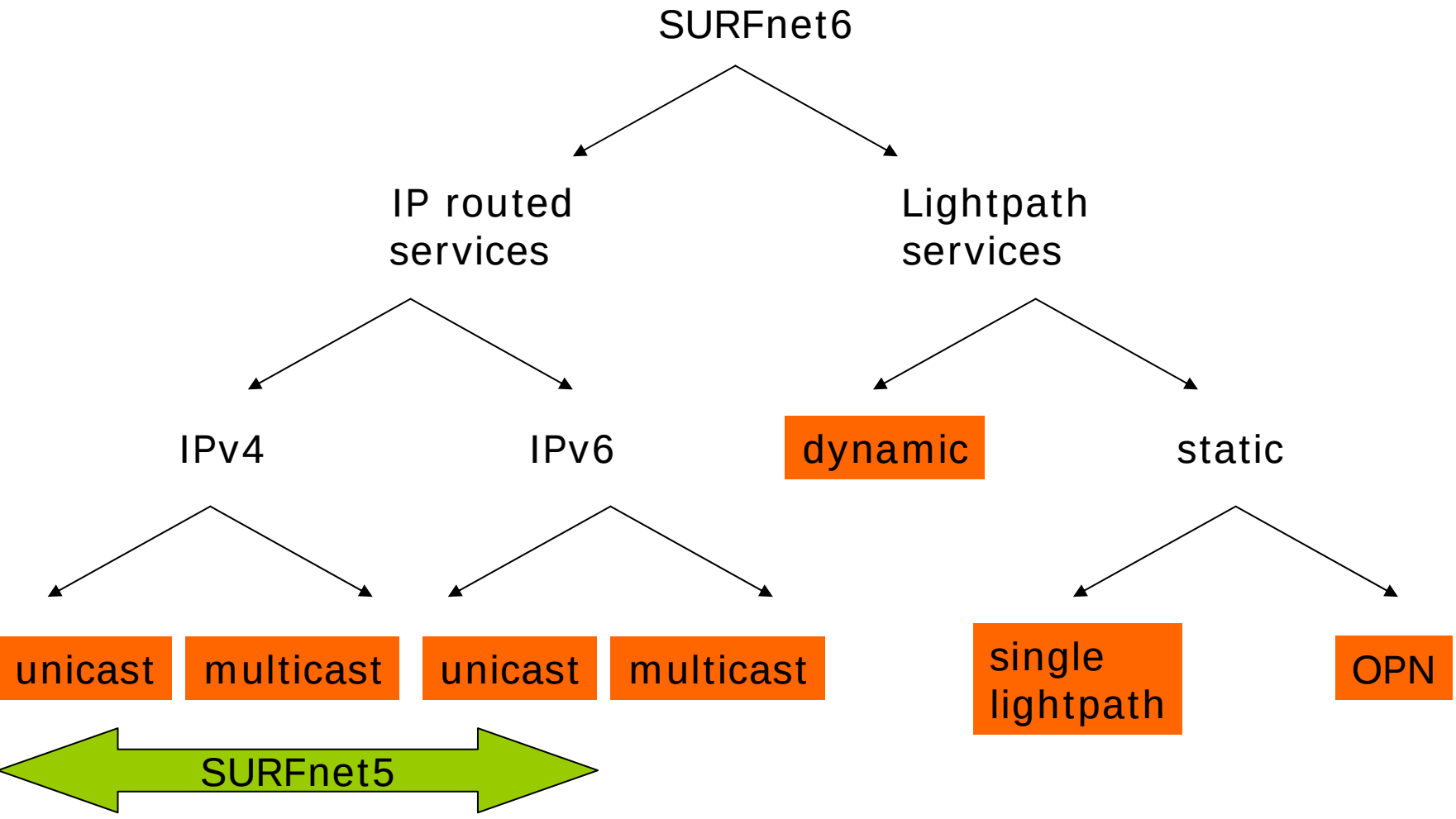
SURFnet6 time schedule



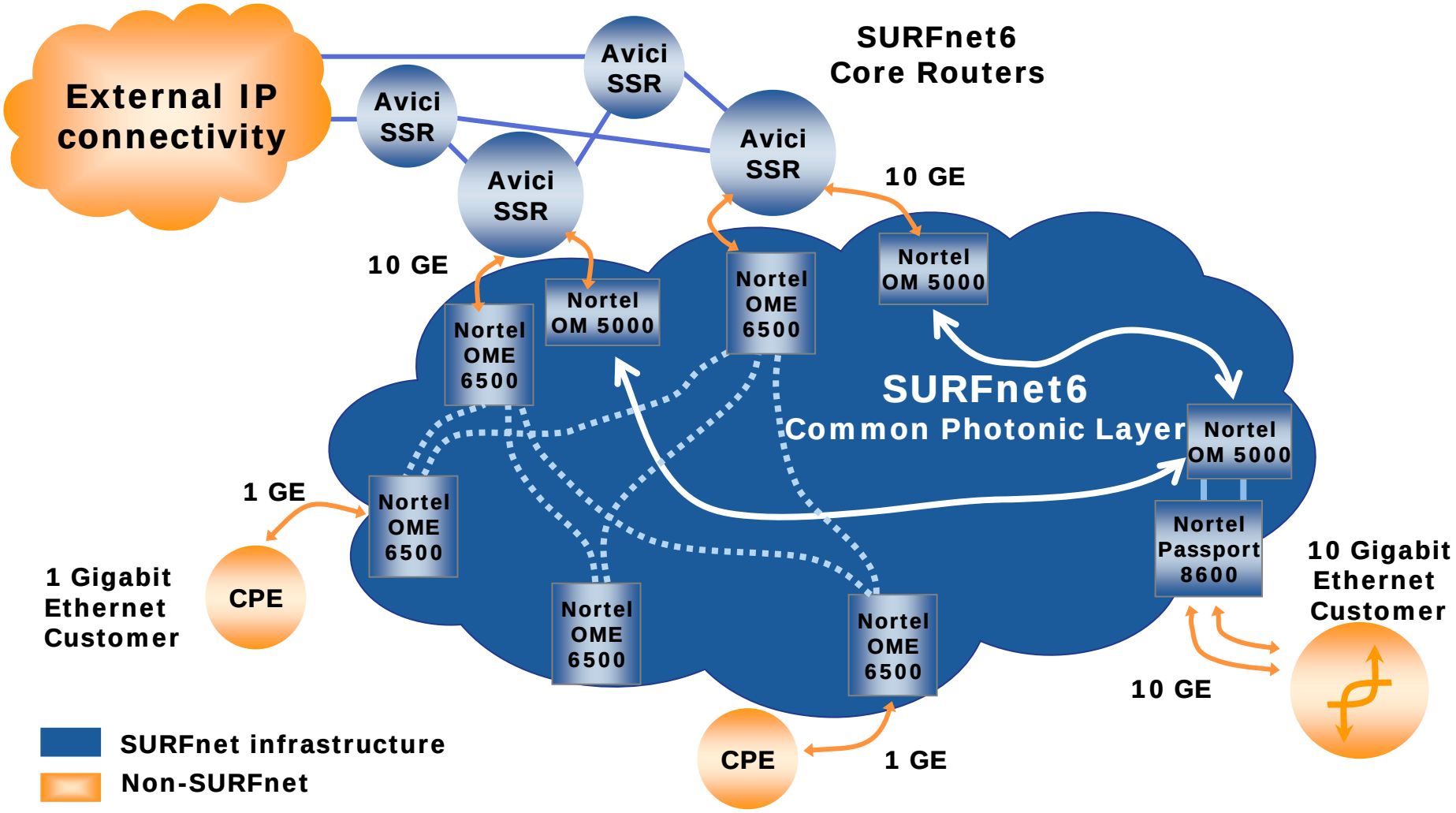
SURFnet6 DWDM on dark fiber



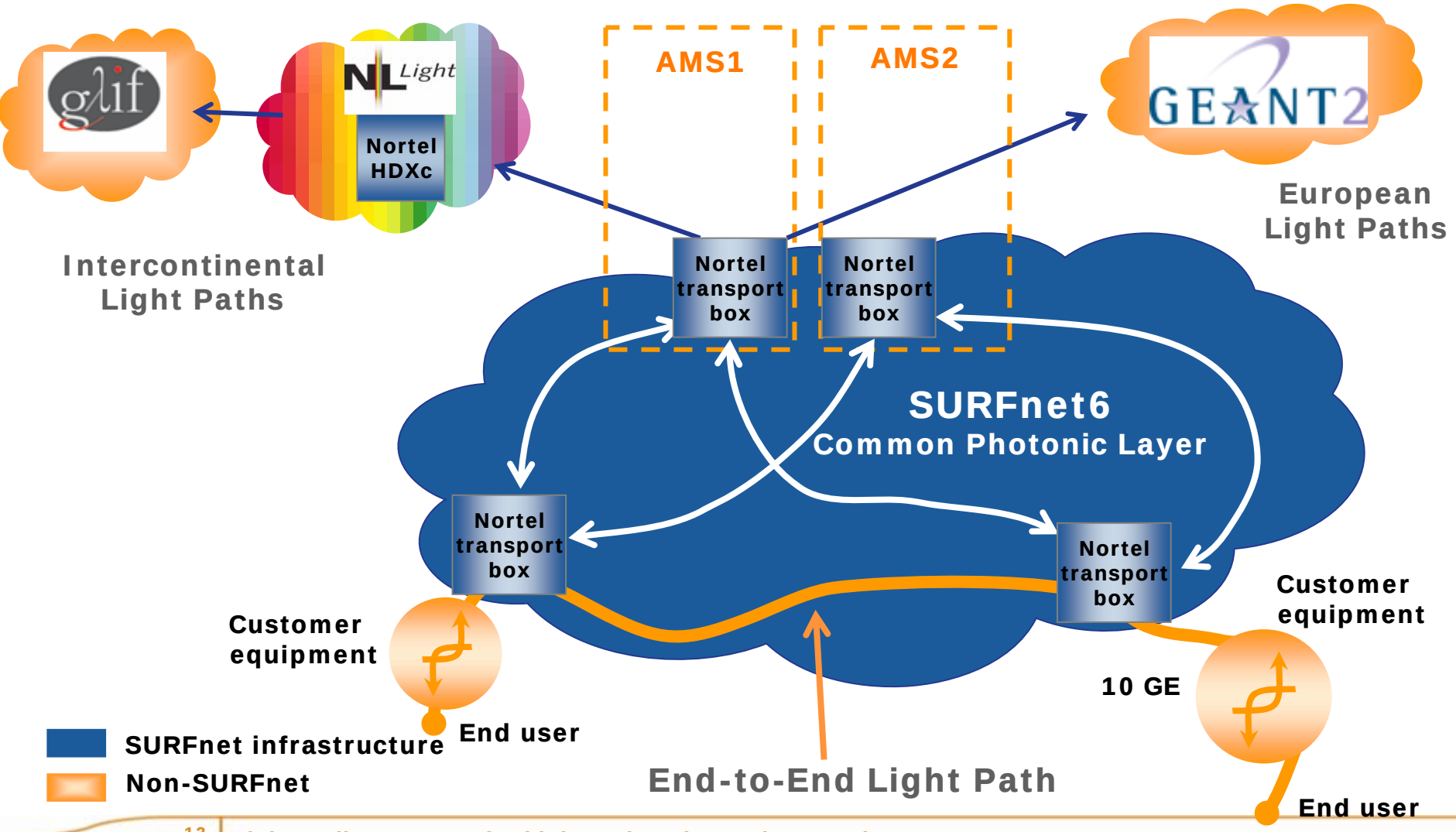
Services on SURFnet6



SURFnet6: IP services



SURFnet6: light path services



Status SURFnet6

- Network accepted from Industry Partner at end of 2005
- SURFnet6 NOC fully operational
- Transition of connected organizations finalized mid June 2006:
  - 180 organizations = 370 ports
  - External connections, such as AMS-IX, GEANT2 and “rest of world” upstream

- SURFnet5 network equipment removed

Developments SURFnet6

- Introduction eDCO (NGM) at various places in network
- Introduction eROADM (WSS) in CPL Subnetwerk 1 for DAS-3/StarPlane
- New IP features in Avici routers
- Cross Border Fiber:
  - Münster, Germany (built and lit)
  - Hamburg, Germany (fiber procured and photonic design ready, in cooperation with NORDUnet and GLORIAD)
  - Aachen, Germany (tender issued, proposals being evaluated)
  - Belgium (being researched)

Focus is now to stimulate use

- **And then there was light…**

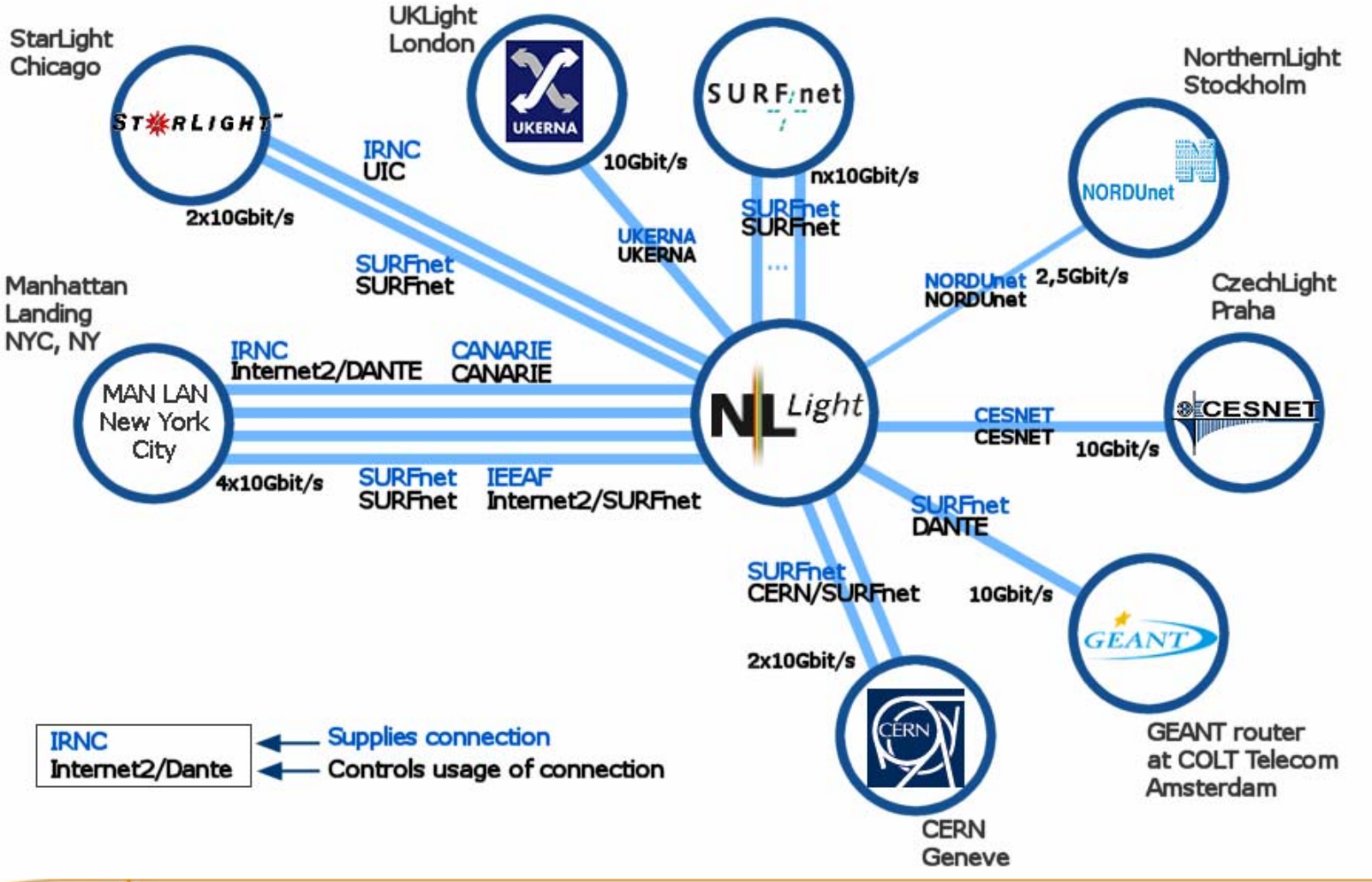
To explain and promote hybrid networking SURFnet commissioned a short film explaining the basic facts and benefits of light paths. The film was produced as a combination of traditional and computer animation. It was shown to great acclaim at the festive opening of SURFnet6 in January 2006.

Involve students as early adopters

- Dutch student accommodations fully equipped for HDTV
  - SURFnet launched a project to upgrade the network facilities of student accommodations in several cities in the Netherlands. As a result, about 5,000 students will be able to view high definition video (HDTV) and use other advanced educational internet services on their computer.

Stimulate new applications

NetherLight



NetherLight technical

- Centered around a Nortel Optical Cross Connect “HDXc”:
  - Up to 640 Gbit/s cross connect capability - i.e. up to 64 x 10G lambdas!
  - Generic Framing Procedure (GFP-F)
  - Partitionable on port basis for management (operator vs. control plane)
- Also: OME6500 for GFP-F mapping and GE switch for apps

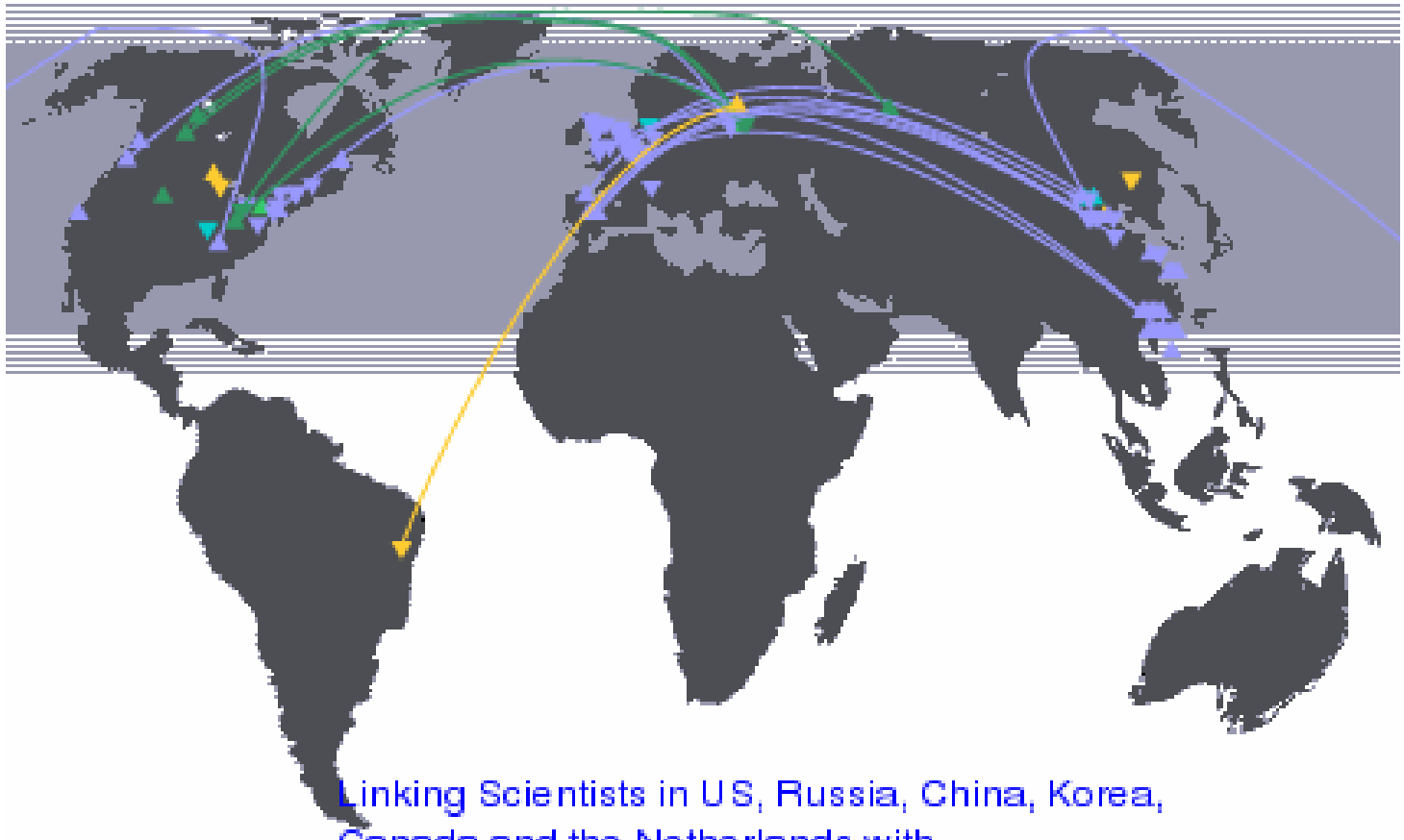
NetherLight Governance

- Follow AMS-IX model from SURFnet pilot to independent service governed by its users in three phases

- Financed and operated by SURFnet
- Financed by users, operated by SURFnet
- Financed and operated by users

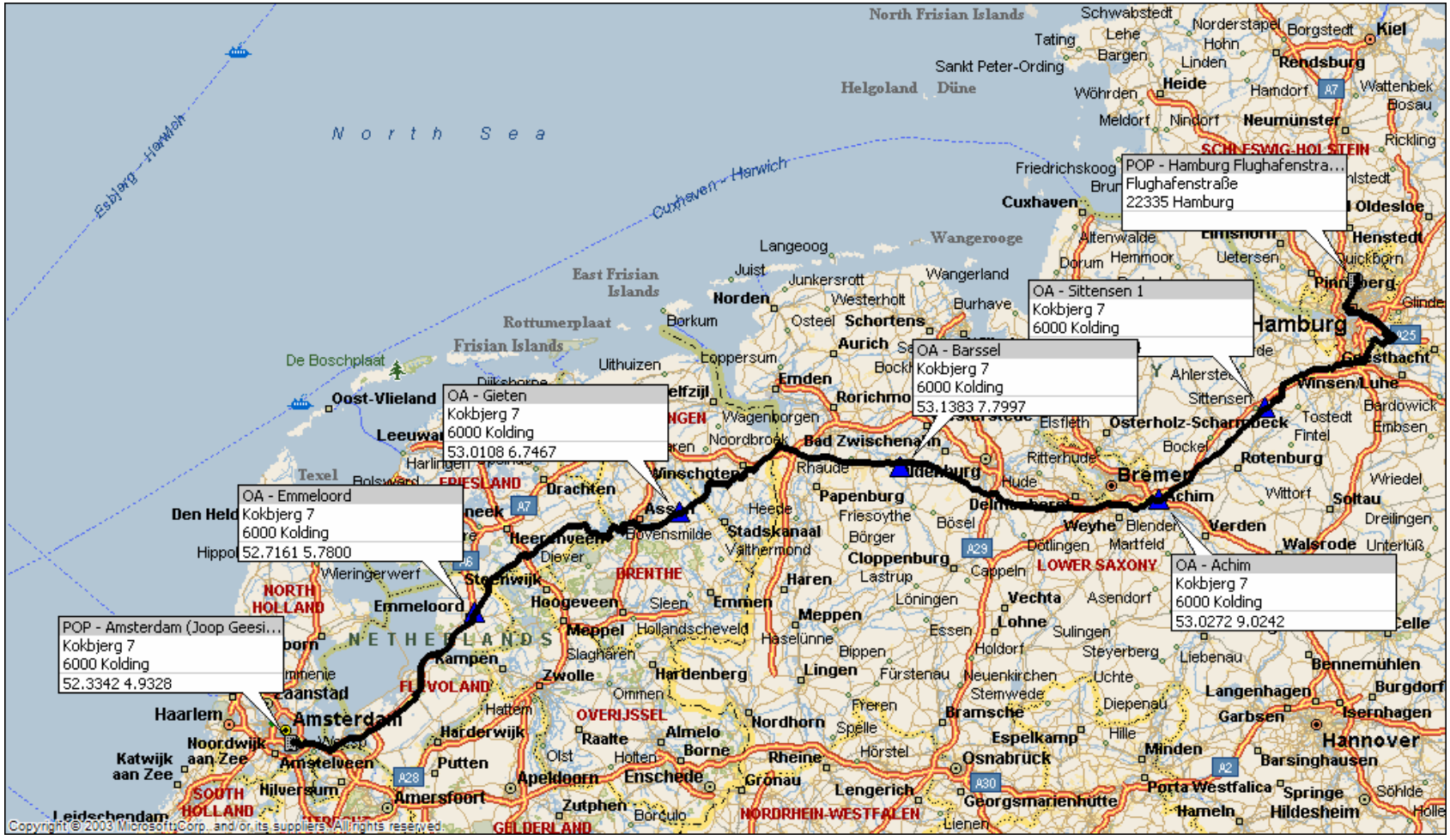
GLORIAD

Global Ring Network for Advanced Applications Development



Linking Scientists in US, Russia, China, Korea, Canada and the Netherlands with High-Performance Network Services

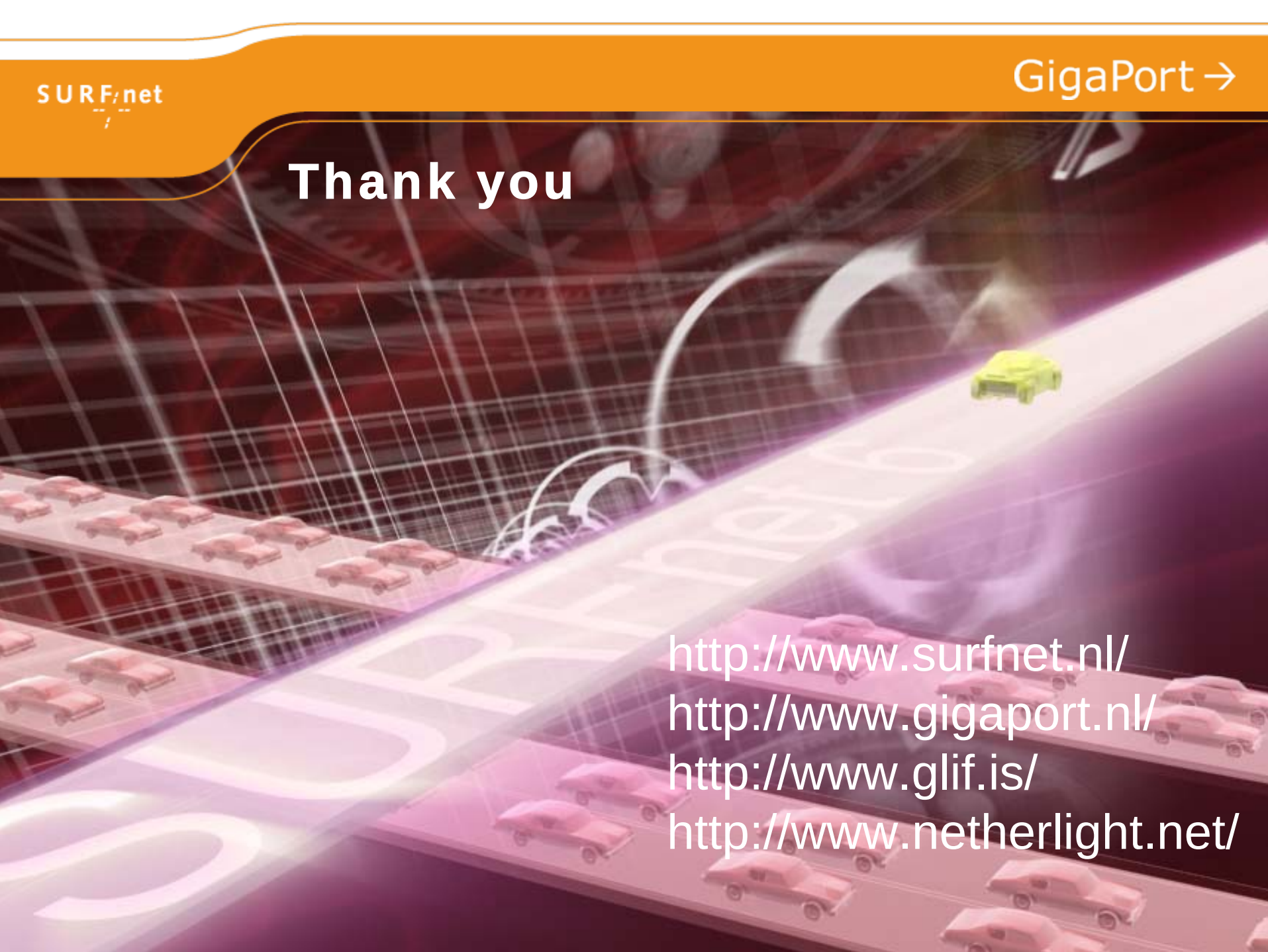
Amsterdam-Hamburg Dark Fiber



Challenges in hybrid networking

- Bringing lightpath services to researchers' desk tops and scientific instruments
- Dynamically provisioning lightpaths by operators and users

- Lightpath provisioning in a multi domain environment
- Network monitoring & management tools
- Inter-domain user authentication and authorisation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